EC6702- OPTICAL COMMUNICATION AND NETWORKS
QUESTION BANK

UNIT I – INTRODUCTION
PART A

1. Write short notes on ray optics theory.
2. What are the advantages and disadvantages of the ray optics?
3. What is meant by refractive index of the material?
4. What is the energy of the single photon of the light whose λ = 1550 nm in eV?
5. What are the conditions for total internal reflection?
6. State Snell's Law.
7. Define – Numerical Aperture
8. Define – Relative Refractive Index Difference
9. A step index fiber has the normalized frequency of 26.6 at 1300 nm. If the core radius is 25 m, find the numerical aperture.
10. Define – Acceptance Angle
11. A silica optical fiber with a large core diameter has a core refractive index of 1.5 and a Cladding refractive index of 1.47. Determine the acceptance angle in air for the fiber.
12. What are meridonal rays?
13. What are skew rays?
14. Write the acceptance angle condition for the skew rays.
15. Define – Critical Angle
16. Assume that there is a glass rod of refractive index 1.5 surrounded by air. Find the critical incidence angle.
17. Draw the block diagram of an optical communication system.
18. The relative refractive index difference for an optical fiber is 1%. Determine the critical angle at the core cladding interface if the core refractive index is 1.46.
19. Which photo diode is used for a low power optical signal and why?
20. What is V number of a fiber?
21. What are guided modes?
22. Define – Phase Velocity
23. Define – group velocity
24. What is meant by mode coupling? What causes it?
25. What are the uses of optical fibers?
26. What is the necessity of cladding for an optical fiber?
27. What is step index fiber?
28. Write the refractive index expression for step index fiber. 29.What is a linearly polarized mode?
30. For n_1 = 1.55 and n_2 = 1.52. calculate the critical angle and numerical aperture
31. calculate the cut off wavelength of a single mode fibre with core radius of 4 m and index difference= 0.003
32. For a fiber with core refractive index of 1.54 and fractional refractive index difference of 0.01. Calculate its numerical aperture
33. Write the refractive index expression for step index fiber.
34. What are the advantages of graded index fiber?
35. Write the refractive index expression for graded index fiber.
36. Write a short note on single mode fiber.
37. List the advantages of multimode fiber over single mode fiber
38. List the advantages and disadvantages of monomode fiber.

39. Define – Mode field Diameter
40. Why is step index single mode fiber preferred for long distance communications?
41. Define – Birefringence
42. What is a graded index fiber ? (A/ M 08)
43. What are the advantages of optical communications?
44. Define – normalized frequency

PART B

1. Explain with neat diagram the elements of an optical fiber transmission link (10)
2. Discuss the evolution of fiber optic communication system (6)
3. The relative refractive index difference between the core and the cladding of a graded index fiber is 0.7% when the refractive index at the core axis is 1.45.Estimate values for the numerical aperture of the fiber along the axis when the index profile is assumed to be triangular
4. Derive an expression for numerical aperture of a step index fiber (10)
5. The relative refractive index difference between the core and the cladding of a graded index fiber is 0.7% when the refractive index at the core axis is 1.45.Estimate values for the numerical aperture of the fiber along the axis when the index profile is assumed to be triangular
6. Discuss the mode theory of circular waveguides.(8)
7. Discuss briefly about linearly polarized modes.(6)
8. Draw the structures of single and multimode step index fibers and graded index fiber with their typical dimensions (6)
9. Mention the advantages of optical fiber communication systems. (4)
10. Derive an expression to determine the modes propagating in step index fiber (11)
11. Calculate the numerical aperture, cut-off parameter and number of modes supported by a fiber having μ1(core) = 1.54, μ2(cladding) = 1.5, core radius 25μm and operating wavelength 1300nm. (5)
12. Explain the phenomenon of total internal reflection using Snell's law with figures and calculations.(12)
13. Distinguish step index from graded index fibers.(4)
14. Calculate NA of silica fiber with its core refractive index (n1) of 1.48 and cladding refractive index of 1.46. What should be the new value of 'n' in order to change the NA to 0.23?(4)
15. Draw and explain the acceptance angle and numerical aperture of an optical fiber and derive expressions for both.(8)
16. A fiber has a core radius of 25mm, core refractive index of 1.48 and relative refractive index difference is 0.01. If the operating wavelength is 0.84mm, find the value of normalized frequency and the number of guided modes. Determine the number of guided modes if D is reduced to 0.03.(8)
17. What is the numerical aperture of an optical fiber? Deduce an expression for the same.
18. What are the various features of graded index fiber? Explain the refractive index profile and ray transmission in a multimode graded index fiber (16)
19. Draw and explain ray theory transmission in an optical communication.
20. With diagram, explain acceptance angle, numerical aperture and total internal reflection.
21. With diagram, explain electromagnetic mode theory of optical propagation.
22. Explain the ray theory of a fiber with special mention about TIR, acceptance angle and NA.
23. Describe single mode fibers and their mode- field diameter. What are the propagation modes in them? (8)

24. Derive the mode equations for a circular fiber using Maxwell's equations. (8)
25. With the help of a block diagram explain the different components of a optical fiber link. (12)
26. Compare the optical fiber link with a satellite link. (4)
27. Explain the differences between meridonal and skew rays. (4)
28. Bring out the differences between phase and group velocities. (6)
29. Deduce an expression for NA of a fiber with the help of a neat figure showing all the details.(6)

UNIT 2
TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS
PART A

1. What are the losses (or) signal attenuation mechanism in a fiber?
2. Define – signal Attenuation of fiber loss
3. Name three different mechanism caused by absorption.
4. Write Urach's rule.
5. What are the types of linear scattering losses?
6. A 30 km long optical fiber has an attenuation of 0.8 dB/ km. If 7 dBm of optical power is launched into fiber, determine the output power in dBm.
7. What are the types of linear scattering losses?
8. What is meant by intrinsic absorption in optical fiber?
9. What is meant by extrinsic absorption in optical fiber?
10. Mention the way to reduce macro bending losses
11. Define – Fictive Temperature
12. What are the types of nonlinear scattering losses?
13. What is meant by Fresnel reflection?
14. Define – dispersion in optical fiber
15. What is Rayleigh scattering?
16. What is meant by mechanical splice
17. What are the two reasons for chromatic dispersion
18. What are the most important non- linear effects of optical fiber communication?
19. What are the factors that cause Rayleigh scattering in optical fibers?
20. What is meant by dispersion in optical fiber?
21. What are the different types of dispersion?
22. What is meant by intermodal dispersion?
23. Define – Group Velocity Dispersion(GVD)
24. What is meant by modal noise?
25. What is meant by cross talk?
26. What is meant by chromatic dispersion?
27. Define – Polarization
28. What are the types of fiber joints?
29. What is meant by fiber splicing?
30. What are the techniques used in splicing?
31. State the drawbacks of fusion splicing?
32. What is coupling efficiency?
33. What is coupling efficiency?
34. Mention the three types of fiber couplers.
35. List out the various loss parameters with four port couplers.
36. Distinguish between dispersion shifted and dispersion flattened fibers.

PART B

1. What is the mean optical power launched into an 8km length fiber is 120MW, the mean optical power at the fiber output is 3μW. Determine
   (1)Overall signal attenuation in dB/km and
   (2)The overall signal attenuation for a 10km optical link using the same fiber With splices at 1km intervals, each giving an attenuation of 1dB.(6)
   2. Explain with suitable diagrams the different mechanisms that contribute to attenuation in optical fibers.(10)

3. Discuss in detail the intermodal dispersion with relevant expressions and diagrams. (10)
4. Write a brief note on design optimization of single mode fibers (6)

5. With aid of diagrams discuss the various losses occurring in optical fibers.(16)

6.A 6km optical link consists of multimode step index fiber with a core refractive index of 1.5 and a relative refractive index of 1%. Estimate the delay difference between the slowest and fastest modes at the fiber output and the rms pulse broadening due to intermodal dispersion on the link. Also derive the expression involved in it. (8)
7. Explain the scattering and bending losses that occur in an optical fiber with relevant diagrams and expressions. (8)
8. Discuss polarization mode dispersion and its limitations.(8)
9.Discuss material and waveguide dispersion mechanisms with necessary mathematical expressions. (8)
10.Write a brief note on pulse broadening in graded index fibers.(8)

11. Explain the effects of signal distortion in optical waveguide (12)

12.Explain the effects of signal distortion in optical waveguide.(12)

13. Compute the total intermodal, intramodal and total dispersion for a fiber having fiber length 1km, line width 50nm, intermodal and intramodal dispersions5ns/km and 80 pcs/km respectively. (4)

14. What do you mean by pulse broadening? Explain its effect on information carrying capacity of a fiber .(12)

15. An LED operating at 850 nm has a spectral width of 45 nm, what is the pulse spreading in ns/km due to material dispersion? What is the pulse spreading when a laser diode having a 2nm spectral width is used? The material dispersion is 90ps/nm.km.(4) (N/ D 11)
16.What is meant by 'fiber splicing'? Explain fusion splicing of optical fibers.
17. Explain expanded beam fiber connector with a neat schematic. (8)
18. Explain the following with necessary diagram and expressio ns
(i) Non linear scattering loss and fiber bend loss.
(ii) Material dispersion in optical fiber. (16)
19.Explain mechanical splices with neat diagrams.(8)
20. Write a brief note on fiber alignment and joint loss.
21. What are the losses on signal attenuation mechanisms in a fiber? Explain in detail (16)
22. Derive expressions for material dispersion and waveguide dispersion and explain them.
23.Describe the various types of fiber connectors and couplers. (8)
24. Explain fiber alignment and joint losses. (6)
25. Describe various fiber splicing techniques with their diagrams. (10)
26. Discuss the attenuation encountered in optical fiber communication due to Bending, Scattering and Absorption. (12)
27. Clearly bring out the differences between intra and inter modal dispersion. (12)
28. Find the maximum bit rate for the fiber link of 5 Kms. The numerical aperture is 0.25and the refractive index is 1.48. (4)
29. Explain the attenuation and losses in fiber
30. With diagram, explain intra and inter modal dispersion. (M / J 14)

UNIT -3
SOURCES AND DETECTORS
PART A

1. Compare and contrast between surface and edge emitting LEDS
2. What is the significance of intrinsic layer in PIN diodes?
3. Calculate the band-gap energy for an LED to emit 850 nm
4. Define – Detector Response Time
5. What do you mean by hetero junction? Mention its advantages?
6. List the different types of mechanical misalignments that can occur between two joined fibers.
7. Distinguish direct and indirect band- gap materials.
8. Why is silicon not used to fabricate LED or Laser Diode?
9. What are the advantages of LED?
10. An LED has radiative and non- radiative recombination times of 30 and 100 ns respectively. Determine the internal quantum efficiency.
11. When a LED has 2V applied to its terminals, it draws 100 mA and produces 2 mW of optical power. Determine the conversion efficiency of the LED from electrical to optical power.
12. What is the principle of operation of LASER?
13. Define – the three modes of cavity of LASER
14. What is a DFB LASER? What is the main difference from the other LASER?
15. What is population inversion?
16. Write the three modes of the cavity of LASER diode
17. State the three key processes of LASER action. Define them.
18. Compare LED ad ILD sources.
19. What are the advantages of Quantum well LASERS?
20. Define – Internal Quantum Efficiency
21. Define – External Quantum Efficiency
22. Calculate the external differential quantum efficiency of a LASER diode operating at 1.33 m, the slope of the straight line portion of the emitted optical power P versus drive current I is given by 15 mW/ ma.
23. Define – Quantum Efficiency of a photo detector
24. Define – Responsivity of a photo detector.
25. Compare the performance of APD with PIN diode.
26. GaAs has a band gap energy of 1.43 eV at 300 K. Determine the wavelength above which an intrinsic photo detector fabricated from this material will cause to operate.
27. List the benefits and drawbacks of avalanche photo diodes.

PART B

1. Draw and explain the LED structures based Double Hetrostucture configuration.(8)
2. Discuss the principle of operation of LASER diodes. What are the effects of temperature on the performance of a LASER diode? (8)
3. Explain the different lensing scheme available to improve the power coupling efficiency.(8)
4. Explain the fiber splicing techniques with necessary diagrams.(8)
5. Explain briefly the three key processes involved in the laser action .Describe for a fabry perot resonator laser diode, modes and threshold conditions. Obtain its rate equations for steady state output.(16)
6. What type of materials are used for optical sources. What are the advantages of double Hetro structure. Compare surface emitting and edge emitting LED structures (8)
7. Derive an expression for the internal optical power level generated in LEDs.(8)
8. Draw and explain the different structures used to achieve carrier and optical confinement in

laser diodes. (8)

9. Discuss the effects of temperature on the performance of a laser diode. (4)
10. Give a brief account of the modulation of an LED. (4)
11. Derive expressions for the power coupled from a surface emitting LED into step index and graded index fibers.(10)
12. Explain the mechanical misalignments that can occur between two joined fibers with necessary diagrams. (6)
13. Explain the step involved in splicing the fiber. Discuss the various splicing techniques employed between two fibers. (8)
14. Explain the lensing schemes used to improve optical source - to- fiber coupling efficiency
15. Explain the basic LED configurations used as optical source. Derive the expression for quantum efficiency and optical power generated in LED's.(10)
16. Explain the modulation process involved in LED and discuss its frequency response (6)
17. Compare LED with a LASER diode.
18. With the help of a neat diagram explain the construction and working of a surface emitting LED?
19. A silicon p- i-n photodiode incorporated into an optical receiver has a quantum efficiency of 60% when operating at a wavelength of 0.9mm. The dark current is 3 nA and the load resistance is 4 KΩ. The incident optical power is 200 nW and the post detection bandwidth of the receiver is 5 MHZ. Calculate the root mean square (rms) shot noise and thermal noise currents generated.
20. Draw and explain surface and edge emitting LEDs.
21. Explain any two injection laser structures with neat diagrams.
22. Draw the structures of SLED and ELED and explain their principle of operation.(8)
23. Draw the injection laser diode structure and explain lasing in it. (8)
24. Draw the structures of PIN and APD photo detectors and explain their operations.(8)
25. Derive the expressions for the SNS of both PIN and APD by incorporating all noise sources.
26. Draw and compare the construction and characteristics of PIN and avalanche photo diode.

UNIT -4
FIBER OPTIC RECEIVER AND MEASUREMENTS
PART A

1. Define – Quantum Limit
2. What is meant by (1/f) noise corner frequency?
3. Why silicon is preferred to make fiber optical receivers?
4. What are the desired features of a photo detector?
5. GaAs has band gap energy of 1.43 eV at 300 k. Determine the wavelength above which an intrinsic photo detector fabricated from this material will cease to operate ?
6. Define – Responsivity of a photo detector.
7. Compare the performance of APD and POIN diode.
8. Define – Modal noise and mode partition noise.
9. Mention the benefits and drawbacks of APD.
10. Why semiconductors based photo detectors preferred to other types of photo detectors. 11. Mention the error sources in fiber optical receiver.
12. What are the methods used to measure fiber refractive index profile
13. Define – Bit Error Rate
14. Define – Extinction ratio
15. List the advantages of preamplifiers.
16. What are the types of preamplifiers?
17. How does dark current arise?
18. What is inter symbol interference?
19. List the benefits and drawbacks of avalanche photodiodes.
20. What is dark current?
21. List out the various error sources.
22. What are the error sources of receiver?
23. Define – long wavelength cutoff of a photodiode
24. A given APD has a quantum efficiency of 65% at a wavelength of 900 nm. If 0.5 W of optical power produces a multiplied photo current of 10 A, find the multiplication M
25. What are the desired features of a photo detector?
26. Why are semiconductor based photo detectors preferred to other types of Photo detectors?
27. What are the receiver error sources?
28. Describe the term Quantum Limit.

PART B

1. A silicon p- i-n photodiode incorporated into an optical receiver has aquantum efficiency of 60% at a wavelength of 0.9 μm.The dark current is 3 nA and load resistance is 4 KΩ. The incident optical power is 200nw and the receiver bandwidth is 5Mhz. Determine
   (1) mean square quantum noise current,
   (2) mean square dark current and
   (3) mean square thermal noise current at a temperature of 20◦C. (8)
2. Draw and explain the operation of APD (8)
3. Derive an expression for the bit error rate of an optical digital receiver (10)
4. Discuss the different noise sources and disturbances in the optical pulse detection mechanism (6)
5. Explain the operation of avalanche photodiode (10)
6. The quantum efficiency of a particular silicion RAPD is 80% for the detection of radiation at a wavelength of 0.9 μm, when the incident optical power is 0.5 μW.The output current from the device(after avalanche gain) is 11μA.Determine the multiplication factor of the photodiode under these conditions. (6)
7. Draw the circuit diagram of high impedance pre-amplifier and explain its operation.

8. Discuss the sources of errors in optical receivers (8)

9. Discuss with necessary expressions that different types of noise that affect the performance of a photo detector (10)

10. When 3×10^{11} photons each with a wavelength of 0.85μm is incident on the photodiode, on the average 1.2×10^{11} electrons are collected at the terminals of the device. Determine the quantum efficiency and responsivity of the photodiode at 0.85μm.(6) (N/ D 08)

11.Explain the operation of pre-amplifier built using a FET.

12. Discuss the noise and disturbances affecting the optical detection Systems.

13. Draw and explain the operation of high impedance FET and BJT pre- amplifiers. (M/J

14.Explain the following measurements.

I.Attenuation measurement using cut back techniques.

II. With suitable diagram, explain optical receiver operation and its performance.

15.Describe the dispersion and numerical measurements of fiber.

UNIT – 5
OPTICAL NETWORKS
PART A

1. What is a broadcast and select network?
2. What is a soliton?
3. What were the problems associated with PDH networks
4. Enumerate the various SONET / SDH layers?
5. What are the three topologies used for fiber optical network?
6. What are the drawbacks of broadcast and select networks for wide area network applications?
7. Define – WDM
8. What is EDFA ?
9. What is the purpose of rise-time budget analysis?
10. Distinguish between fundamental and higher order soliton?
11. What are the advantages of using soliton signals through fiber?
12. What are the advantages of WDM?
13. What are the standard fiber measurement techniques?
14. Write the concept of link power budget.
15. Write the basic concept of soliton generation.
16. Write the functions of transport and path overhead
17.What is chirping?
18. Draw the frame format of SONET.
19. What is meant by modal noise?
20.Name any two splicing techniques.
21.What are the basic performance criteria of WDM technique?
22.Distinguish fundamental and higher order solitons
23. What are the main parameters used for characterizing the performance of optical amplifiers in a communication system?
24.Give the significance of solitons.
25.List out the benefits of SONET over PDH networks.

PART B

1.Explain the significance of link power budget and rise time budget with one illustration for each. (16)

2.Give a brief account of the principles of SONET (6)

3.Explain the principle of operation of Erbium doped fiber amplifiers (10)
4.Explain the principles of WDM .(8)
5. Explain the salient features of solitons using relevant expressions and diagrams(16)
6. Discuss the concept of WDM with neat diagram (6)
7. Draw and explain the basic format of an STS-N SONET frame
8. Explain the amplification mechanism in EDFA. Discuss the possible configurations of EDFA with neat diagram. (10)
9. Derive the expression for EDFA conversion efficiency and amplifier gain (6)
10. Explain the basic frame format structure and network architecture of SONET. (8)
11.Explain the operation of WDM components (8)
12. Explain the layers of SONET with neat sketches. (8)
13. Describe the operation of unidirectional and bidirectional WDM. (8)
14. Draw and explain the principle of operations of an EDFA. Describe the approaches to achieve flatness in its gain.(8)
15. What are the key system requirements and characteristics required in analyzing a point- point link? (6)
16.Write short notes on (A/M
(i) WDM (8)
(ii) SONET/SDH network.
17.Explain the architecture of SONET and discuss non- linear effects on network Performance
18.Write short notes on
(a) Wavelength routed networks.
(b) Optical CDMA.
19.Explain the principle of solitons and discuss the soliton parameters with necessary expressions and diagrams.
20. Write short notes with necessary diagrams on
(i) Optical CDMA.
(ii) WDM and EDFA system performance.
21. Explain the SA/ SA protocol and modified SA/SA protocol of broadcast and select networks.(8)
22. What are the non- linear effects on network performance? Explain them briefly.(8)
23. Explain the layered architecture of SONET/SDH with neat diagra m. (8)
24. Write a detailed notes on optical CDMA and its applications. (8)
25. What is a ‘four-fiber BLSR ring in a SONET? Explain the reconfiguration of the same during node or fiber failure. (8)
26. What is broadcast- and select multihop network? Explain. (8)
27. Write notes on solitons. (8)
28. Explain the following requirements for the design of an optically amplified WDM link:
i) Link Bandwidth
ii) Optical power requirements for a specific BER. (8)

Assignment Questions

1. An LED operating at 1550 nm has a spectral width of 5 mm. What is the pulse spreading in ns/km due to material dispersion?. What is the pulse spreading when a laser diode having at 2 nm spectral width is used?

2. How pulse broadening is occurring? Discuss pulse broadening in Graded Index Fibers.

3. Explain briefly the three key processes involved in the laser action .Describe for a fabry perot Resonator laser diode, modes and threshold conditions. Obtain its rate equations for steady State output.

4. The quantum efficiency of a particular silicon RAPD is 80% for the detection of radiation at a wavelength of 0.9μm, when the incident optical power is 0.5μW.The output current from the device (after avalanche gain) is 11μA.Determine the multiplication factor of the photodiode under these conditions.

5. What is a 'four-fiber BLSR ring in a SONET? Explain the reconfiguration of the same during node or fiber failure.

Advanced Computer Architecture

UNIT 1
Fundamentals of Computer Design

1.What are the five classic components of a computer?
2. Define ISA
3. What are the advantages of network computers?
4. What are the functions of control unit ?
5. Define Response Time
6. Define Throughput
7. Write the CPU performance equation.
8. What are the basic components of performance?
9. Define dependability.

10. Define latency.
11. Define bandwidth.
12. Define Latency Time and Throughput of a computer System
13. What are the types of implementation technology?
14. What is dynamic energy?
15. What are the factors influencing the cost of computer?
16. How to calculate the cost of the integrated circuit?
17. what is dependability?
18. what is execution time?

19. How the performance of the system is calculated?

20. Define Amdhals Law.

UNIT 2
Instruction Level Parallelism

1.What is meant by ILP?
2.What are the needs of ILP?
3. What is multiple issue? Write any two approaches.
4. What is meant by speculation?
5. Define Static Multiple Issue
6. Define Issue Slots and Issue Packet
7. Define VLIW
8. Define Superscalar Processor
9. What is meant by loop unrolling?
10. What is meant by anti-dependence? How is it removed?
11.What is the use of reservation station and reorder buffer?
12. Differentiate in-order execution from out-of-order execution.
13. What is meant by hardware multithreading?
14. What are the two main approaches to hardware multithreading?
15.What is meant by pipelining?
16.What is meant by forwarding
17. What is pipeline stall?
18. What is meant by branch prediction?
19.How to calculate the value of CPI.
20.What are the four steps involved in instruction execution.
21.What are the various data hazards.

UNIT 3
Data-Level Parallelism

1. What is a vector processor?
2. Define vector mask registers
3. What is a stride?
4. What is a roofline model?
5. What are the primary components of VIMPS?

6. List the factors that depend on execution of vector operations
7. What is strip mining?
8. What is the limitation of VLIW processors?
9.Define a thread.
10. Define CUDA thread and thread block
11. What is loop carry dependency?
12. What is GPU?
13. Differentiate GPU and CPU.
14. What is SIMD?
15. What is scalar and vector register?
16. What is arithmetic intensity?
17. What is purpose multiple lane?
18. What is a VLIW processor and its advantages?
19.What is the function of Vector Mask Register?

UNIT 4
Thread Level Parallelism

1. What is write serialization?
2. What is snoop cache and write through cache?
3. What. is symmetric shared memory ?
4.What is private data and shared data?
5. What happens when a private and shared item is cached?
6. What is cache coherence?
7. What Is Multiprocessor Cache Coherence?
8. What is meant by coherence?
9. What is meant by consistency?
10. What are the schemes provided by coherent multiprocessor?
11. The overall cache performance is based on what attributes?
12. What are types of coherence misses?
14. Difference between symmetric shared memory and distributed shared memory.
15. What is multithreading?.
16. What is SMT?
17. What are the design issues of SMT and CMP architecture ?
18. Why do we need synchronization?
19. What is the importance of models of memory consistency?
20. What are the methods for synchronization?
21. List out the demerit of distributed shared memory architecture.

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UNIT 5
Memory and I/O

1. What Is Meant By Cache Memory?
2. What are the various memory technologies?

3. Differentiate SRAM from DRAM.
4. Define − Rotational Latency.
5. What is direct-mapped cache?
6. Define memory access time?
7. Define memory cycle time.
8. Define Static Memories.
9. Distinguish Between Static RAM and Dynamic RAM?
10. Distiguish between asynchronies DRAM and synchronous RAM.
12. what is an I/O channel?
13. Why program controlled I/O is unsuitable for high-speed data transfer?
14. What is the function of i/o interface?
15. What are the basic cache optimizations?.
16. What are the advanced cache optimizations?
17. What is hit under miss?
18. How to calculate Average memory access time2-way ?
19. What is false sharing miss?
20.What is non-blocking cache?
21.Define hit rate.

PART –B Questions

UNIT I

1. State the Amdahlslaw,define speedup and derive the speedup equation
2. Explain in detail about the trends in technology
3. Explain in detail about the trends in power energy
4. Explain in detail about the trends in cost
5. Discuss about the Multicore era in detail
6. Describe the major factors that influence the cost of computer and how these factor are changing over time
7. Discuss about the CPU performance parameters.
8. Discuss the classes of parallelism
9. Explain in detail about fundamentals of computer.
10. Explain the following term

a. Module reliability
b. Module availability

UNIT II

1. Explain how dynamic scheduling helps in overcoming data hazards caused by instruction level parallelism.
2. Write a detailed note on Hardware-based speculation in instruction level parallelism
3. Discuss about the benefits and limitations of static and dynamic branch prediction
4. Briefly explain how to overcome data hazards with dynamic scheduling using Tomasulas approach.
5. Discuss about any two compiler techniques for exposing ILP in detail
6. Explain how ILP is achieved using dynamic scheduling.
7. Explain the static and dynamic branch prediction schemes in detail.
8. Explain the Tomasulo's Approach used in dynamic scheduling for overcoming data hazards
9. Describe how the compiler technology can be used to improve the performance of instruction

level parallelism.
10. What is instruction level parallelism? Explain in detail about the various dependences caused in ILP
11. Briefly compare hardware and software speculation mechanisms

UNIT III

1. Discuss in detail the vector architecture, vector operations and enhancement of the performance.
2. Discuss in detail the vector instruction set.
3. Explain in detail about execution time of vector architecture.
4. Explain in detail about GPU
5. Discuss about vector architecture in detail
6. Explain Vector Architecture (VMIPS),vector execution time, Vector Multiple Lanes, Vector Mask Register, Memory Banks in detail.
7. Explain Roofline Visual Performance model
8. Explain NVIDIA GPU Computational Structures, GPU Instruction Set Architecture, Conditional branching n detail.
9. Discuss about FERMI Architecture in detail and compare Vector Architecture and GPU's ,Multimedia SIMD and GPU's
10. How to enhance Loop Level parallelism? Discuss in detail.
11. How to achieve Synchronization and locks for achieving Coherence in detail.

UNIT-IV

1. Explain the distributed memory architecture with different message passing mechanisms.
2. With neat block diagram explain the centralized shared memory multiprocessor architecture.
3. Discuss the Performance of symmetric shared memory multiprocessor and their effects with example
4. Discuss the importance of various models of memory consistency.
5. Explain the Directory –based cache coherence protocol in distributed shared memory architecture.
6. Explain the basic architecture of a distributed memory multiprocessor system.
7. Explain various memory consistency models in detail
8. Describe the basic structure of a centralized shared-memory multiprocessor in detail
9. What are the advantages and disadvantages of distributed-memory Multiprocessors? Describe the basic structure of a distributed memory multiprocessor in detail
10. Discuss about the synchronization techniques used in multiprocessor systems.
11. Discuss the various cache-coherence protocols used in symmetric shared memory architecture

UNIT V

1. Analyze the performance of the I/O Systems.
2. Explain in detail about various types of storage devices
3. Discuss about various cache hit time reduction techniques for improving the cache performance.
4. Briefly explain various I/O performance measures
5. Describe the optimizations technique used in compilers to reduce cache miss rate
6. Briefly describe standard RAID levels in detail

7. Discuss the various techniques available for reducing the cache miss rate
8. Explain the various ways to measure I/O performance
9. Explain in detail about the cache memory
10. Explain the following term:

a. Reducing cache hit
b. Reducing cache miss

EC-6016 OPTOELECTRONIC DEVICES

UNIT-I

Part-A:

1. Define optoelectronics.
2. Define optoelectronic devices.
3. What do you meant by corpuscular theory?
4. Give the expression for wave nature of light.
5. Define Snell's law.
6. What do you meant by the term interference?
7. What is meant by diffraction?
8. What do you meant by the term wavefront?
9. What are light sources and name the different types of light sources?
10. What are blackbody sources?
11. What are line sources?
12. What do you understand by the quantum mechanical concepts of light?
13. What do you meant by semiconductors and name the different types of semiconductors?.
14. What are intrinsic semiconductors?
15. What are extrinsic semiconductors?
16. List out the major differences between intrinsic and extrinsic semiconductors.
17. Define radiative recombination and non-radiative recombination process.
18. Name the two ways in which recombination can occur?
19. Explain about band-to-band recombination and defect center recombination.
20. What are Miller indices of crystal?

Part-B:

1. Derive and explain in detail the Schrödinger's wave equation.
2. Derive the electron energy in one electron atom using wave equation.
3. Describe in detail the position of Fermi level in semiconductor at equilibrium.
4. Explain in detail about Hall Effect
5. Explain the various parameters and characteristics of semiconductor Hetero junction materials.

UNIT-II

Part-A:

1. What do you meant by display devices?
2. What are the different luminescent processes?
3. Define the different types of luminescent processes.
4. Name the different types of display devices.

5. What are plasma devices?
6. Discuss briefly about LCD.
7. What are the two types of LCD and compare both?
8. What do you meant by nematic ordering and cholesteric ordering?
9. Mention some important LED materials.
10. What are the two common electroluminescent devices?
11. What are numeric display devices?
12. What do you meant by laser?
13. What do you meant by spontaneous emission and stimulated emission?
14. What is meant by population inversion and how it is achieved in laser medium?
15. What are major causes of losses in laser?
16. What do you meant by mode locking?
17. Mention the different classes of laser. The different classes of laser are,
18. State Heisenberg's uncertainty principle

Part-B :

1. Explain Emission, Absorption, and Radiation of Laser

2. Explain the construction and working of various Display devices.

3. Explain the following terms.

(i).Photo luminescence.

(ii).Cathode luminescence.

(iii).Electro luminescence.

(iv).Injection luminescence.

4. Describe about the Mode locking of semiconductor laser.

5. Explain in detail the application of laser.

6. Discuss about the various Classification of laser.

UNIT-III

PART-A

1. Explain thermal detectors.
2. What is the internal quantum efficiency of photodetector?
3. Explain photoconductors.
4. What do you mean by Kerr effect?
5. Name the different types of thermal detectors?
6. Define photodetectors.
7. What are the different types of photodetectors?
8. What are the two types of photoconductors?
9. What are the factors that limit the response time of photodiodes?
10. Define responsivity.
11. Define noise equivalent power.

12. Discuss briefly about pin photodiode.
13. How Schottky photodiodes are made?
14. Define Pockels effect.
15. What is a bolometer?
16. What is the working principle of thermal detectors?
17. Define signal to noise ratio in photoconductors.
18. How is a photodiode designed and why it is designed?
19. What are the various processing steps taking place inside a photo detector?

PART-B

1. Discuss in detail about the construction and working of photoconductors, Also explain its classification.

2. Compare the noise performance of Photoconductor and PIN photodiode.

3. Discuss in detail about the construction and working of PIN photodiode.

4. Explain in detail about Hetero junction diode.

5. Explain in detail about avalanche photodiode.

UNIT IV

PART-A

1. Compare analog and digital modulation.
2. Mention the advantages of high bandwidth.
3. Name the different types of electro-optic modulators.
4. What are the drawbacks of analog modulation?
5. Define electro-optic modulators.
6. Define the term electro-optic effect.
7. Define the term birefringence.
8. What are mageneto-optic devices?
9. What are acoustoptic devices?
10. What do you mean by SEED?
11. What are the different types of SEED?
12. Why we go for bipolar controller modulator?
13. What are the advantages of bipolar controller modulator?
14. Mention the categories of acoustoptic devices.
15. What are acoustoptic modulators?
16. What are the limitations of acoustoptic modulators?
17. Define acoustoptic filter.

18. Define collinear filter and non-collinear filter.
19. What are acoustoptic deflectors?

PART-B

1. Differentiate Analog and Digital modulation techniques.
2. What is Electro-Optic Effect? and explain how this is suitable for electro-optic phase modulation

   and electro-optic amplitude modulation.
3. Explain Quadratic Electro-Optic effect with suitable diagram.
4. Discuss in detail the Operation of Electro-Optic Amplitude modulation with necessary diagram.
5. Explain the operation of Self Electro-Optic device with necessary diagram.
6. Write a short note on Bipolar controller Modulator.
7. Write a short note on Programmable memory devices.
8. Write short notes on the following

   (i).Tunable threshold logic gates

   (ii).Optical crossbar switching

UNIT-IV

1. How guided waves can be formed?
2. What are optoelectronic integrated circuits?
3. What are active guided wave devices and give examples?
4. Distinguish between hybrid and monolithic integration.
5. Mention the applications of optoelectronic integrated circuits
6. List out the advantages of optoelectronic integrated circuits.
7. Mention the types of integrated transmitters.
8. Mention the types of integrated receivers.
9. Define waveguide.
10. Explain briefly about directional coupler.
11. What do you meant by front-end photo receivers?
12. What do you meant by MODFET?
13. Write briefly about hybrid integration.
14. Write briefly about monolithic integration.
15. What are the disadvantages of hybrid integration?
16. How can we achieve monolithic integration?
17. What is the disadvantage of vertical monolithic integration?
18. What is the advantages and disadvantages of horizontal scheme?

19. What is the objective of OEIC?

PART-B :

1. What is the need for integration of opto-electronic devices? Explain it.
2. Explain briefly the application of opto-electronic integrated circuits(OEIC).
3. With neat diagram, Explain the performance of Front end photo receivers.
4. Explain the noise and bandwidth considerations of photo receiver.
5. Explain the various steps involved in the fabrication of OEIC transmitter and also draw the equivalent circuit of integrated transmitter.
6. Explain in detail about the properties of .optical guided wave and couplers.

ASSIGNMENT QUESTIONS

1. A wave is specified by y=8cos2pi(2t-0.8z),where y is expressed in micrometers and the propagation

Constant is given in μm. Find (a) the amplitude,(b) the wavelength,(c) the angular frequency, and (d) The displacement at time t=0 and z=4μm.

2. Consider an LED having a minority carrier lifetime of 5ns.Find the 3-dB optical bandwidth and the 3-dB electrical bandwidth.

3. Consider a quantum-noise-limited analog optical fiber system that uses a PIN diode with a responsivity of 0.85 A/W at 1310nm.Assume the system uses a modulation index of 0.6 and operates in a 40-MHZ bandwidth.If we neglect detector dark current, what is the signal-to-noise ratio when the incident optical power at the receiver is-15dBm?

4. Compare the system margins for 40-km and 80-km long haul OC-48 links at 1550 nm for the minimum and maximum source output ranges.Assume there is a 1.5-dB coupling loss at each end of the link?

5. (a) Calculate how many 64-kb/s voice channels and can be carried by an STS-3,STS-48, and STS-192 system? (b) How many 20-Mb/s digitized video channels can be transported over these systems?

DIGITAL IMAGE PROCCESSING

UNIT I - Digital Image Fundamentals

TWO MARK QUESTIONS

1. Define Image?
2. What is Dynamic Range?
3. Define Brightness?
4. Define Tapered Quantization?
5. What do you meant by Gray level?
6. What do you meant by Color model?
7. List the hardware oriented color models?
8. What is Hue of saturation?
9. List the applications of color models?
10. What is Chromatic Adoption?
11. Define Resolutions?
12. What is meant by pixel?
13. Define Digital image?
14. What are the steps involved in DIP?
15. What is recognition and Interpretation?
16. Specify the elements of DIP system?
17. Explain the categories of digital storage?
18. What are the types of light receptors?
19. Differentiate photopic and scotopic vision?
20. How cones and rods are distributed in retina?
21. Define subjective brightness and brightness adaptation?
22. Define weber ratio
23. What is meant by machband effect?
24. What is simultaneous contrast?
25. What is meant by illumination and reflectance?
26. Define sampling and quantization
27. Find the number of bits required to store a 256 X 256 image with 32 gray levels?
28. Write the expression to find the number of bits to store a digital image?
30. What do you meant by Zooming of digital images?
31. What do you meant by shrinking of digital images?
32. Write short notes on neighbors of a pixel.
33. Explain the types of connectivity.
34. What is meant by path?
35. Give the formula for calculating D4 and D8 distance.

UNIT II - Image Enhancement

1. Specify the objective of image enhancement technique.
2. Explain the 2 categories of image enhancement.
3. What is contrast stretching?
4. What is grey level slicing?
5. Define image subtraction.
6. What is the purpose of image averaging?
7. What is meant by masking?
8. Give the formula for negative and log transformation.
9. What is meant by bit plane slicing?

10. Define histogram.
11. What is meant by histogram equalization?
12. Explain spatial filtering?
13. What is a Median filter?
14. What is maximum filter and minimum filter?
15. Write the application of sharpening filters?
16. Name the different types of derivative filters?
17. What is smoothing spatial filter?
18. What is sharpening spatial filter?
19. Define gradient operators.
20. Define Laplacian.

UNIT III - Image Restoration and Segmentation

1. What is meant by Image Restoration?
2. What are the two properties in Linear Operator?
3. Explain additivity property in Linear Operator?
4. What is meant by Noise probability density function?
5. Why the restoration is called as unconstrained restoration?
6. Which is the most frequent method to overcome the difficulty to formulate the spatial relocation of pixels?
7. What are the types of noise models?
8. Give the relation for guassian noise?
9. Give the relation for rayleigh noise?
10. Give the relation for Gamma noise?
11. Give the relation for Exponential noise?
12. Give the relation for Uniform noise?
13. Give the relation for Impulse noise?
14. What is inverse filtering?
15. What is pseudo inverse filter?
16. What is meant by least mean square filter?
17. What is blur impulse response and noise levels?
18. Give the difference between Enhancement and Restoration?
19. What is segmentation?
20. Write the applications of segmentation.
21. What are the three types of discontinuity in digital image?
22. How the derivatives are obtained in edge detection during formulation?
23. Write about linking edge points.
24. What are the two properties used for establishing similarity of edge pixels?
25. What is edge?
26. Give the properties of the second derivative around an edge?
27. Define Gradient Operator?
28. What is meant by object point and background point?
29. What is global, Local and dynamic or adaptive threshold?
30. Define region growing?
31. Specify the steps involved in splitting and merging?
32. What is meant by markers?
33. What are the 2 principles steps involved in marker selection?

UNIT IV – Wavelets and Image Compression

1. What is image compression?
2. What is Data Compression?
3. What are two main types of Data compression?
4. What is the need for Compression?
5. What are different Compression Methods?
6. Define is coding redundancy?
7. Define interpixel redundancy?
8. Define compression ratio.
9. Define psycho visual redundancy?
10. Define encoder
11. Define source encoder
12. Define channel encoder
13. What are the types of decoder?
14. What are the operations performed by error free compression?
15. What is bit plane Decomposition?
16. What are three categories of constant area coding?
17. How effectiveness of quantization can be improved?
18. What are the coding systems in JPEG?
19. What is JPEG?
20. What are the basic steps in JPEG?
21. What is MPEG?
22. What is zig zag sequence?
23. Define I-frame
24. Define P-frame
25. Define B-frame

UNIT V – Image Representation and Recognition

1. Define chain codes?
2. What are the demerits of chain code?
3. What is thinning or skeletonizing algorithm?
4. Specify the various image representation approaches
5. What is polygonal approximation method?
6. Specify the various polygonal approximation methods
7. Name few boundary descriptors
8. Give the formula for diameter of boundary
9. Define length of a boundary.
10. Define eccentricity and curvature of boundary
11. Define shape numbers
12. Describe Fourier descriptors
13. Give the Fourier descriptors for the following transformations
14. Specify the types of regional descriptors
15. Name few measures used as simple descriptors in region descriptors
16. Define compactness
17. Describe texture
18. Describe statistical approach
19. Define gray-level co-occurrence matrix.
20. Explain structural and spectral approach

16 MARKS

UNIT I - Digital Image Fundamentals

1. Explain the steps involved in digital image processing. (or)
   Explain various functional block of digital image processing
2. Describe the elements of visual perception.
3. Describe image formation in the eye with brightness adaptation and discrimination
4. Write short notes on sampling and quantization.
5. Describe the functions of elements of digital image processing system with a diagram.
6. Explain the basic relationships between pixels?
7. Describe the various color models in digital image processing?

UNIT II - Image Enhancement

1. Explain the types of gray level transformation used for image enhancement.
2. What is histogram? Explain histogram equalization.
3. Discuss the image smoothing filter with its model in the spatial domain.
4. What are image sharpening filters? Explain the various types of it.
5. Explain spatial filtering in image enhancement.
6. Explain image enhancement in the frequency domain.
7. Explain the procedure involved in enhancing the image using histogram specification.
8. Explain the various spatial domain filter approaches for image enhancement.
9. Explain the various frequency domain filter approaches for image enhancement.

UNIT III - Image Restoration and Segmentation

1. Explain the algebra approach in image restoration.
2. What is the use of wiener filter in image restoration? Explain.
3. What is meant by inverse filtering? Explain.
4. Explain singular value decomposition and specify its properties.
5. Explain image degradation model /restoration process in detail.
6. What are the two approaches for blind image restoration? Explain in detail.
7. What is image segmentation? Explain in detail.
8. Explain Edge Detection in details?
9. Define Thresholding and explain the various methods of thresholding in detail?
10. Discuss about region based image segmentation techniques Compare threshold region based techniques.

UNIT IV – Wavelets and Image Compression

1. What is data redundancy? Explain three basic data redundancy?
2. What is image compression? Explain any four variable length coding compression schemes.

3. Explain about Image compression model?
4. Explain about Error free Compression?
5. Explain about Lossy compression?
6. Explain the schematics of image compression standard JPEG.
7. Explain how compression is achieved in transform coding and explain about DCT
8. Explain about Image compression standards?
9. Discuss about MPEG standard and compare with JPEG
10. Define wavelets and its types in detail.

UNIT V – Image Representation and Recognition

1. Define and explain the various representation approaches?
2. Explain Boundary descriptors.
3. Explain regional descriptors
4. Explain the two techniques of region representation.
5. Explain the segmentation techniques that are based on finding the regions directly.
6. How is line detected? Explain through the operators.
7. Explain about texture.
8. Write short notes on boundary representation using chain codes.
9. Explain polygonal approximation.

ASSIGNMENT QUESTIONS

1. Write the elements of an image processing system and its working.
2. Discuss the order-statistics filters.
3. Explain the basic concepts of sampling and quantization.
4. Discuss the histogram processing of a digital image.
5. Illustrate the steps in histogram equalization of the image.

4	4	4	4	4
3	4	5	4	3
3	5	5	5	3
3	4	5	4	3
4	4	4	4	4

EMBEDDED REAL TIME SYSTEMS

TWO MARKS

UNIT-1

EMBEDDED COMPUTING

1.Define Embedded System. What are the components of embedded system?

2.In what ways CISC and RISC processors differ?

3.Define system on chip (SOC) with an example

4.Give any two uses of VLSI designed circuits

5.List the important considerations when selecting a processor.

6.What are the types of embedded system?

7.What are the important embedded processor chips?

8.Classify the processors in embedded system?

9.Name some DSP used in embedded systems?

10.Name some of the hardware parts of embedded systems?

11.What are the various types of memory in embedded systems?

12.What are the points to be considered while connecting power supply rails with embedded system?

13.What is watch dog timer?

14.What does the execution unit of a processor in an embedded system do?

15.Give examples for general purpose processor.

16.What are the two essential units of a processor on a embedded system?

17.Define microprocessor.

18.When is Application Specific System processors ASSPs) used in an embedded system?

19.Define ROM image.

20.Define device driver.

21.Name some of the software's used for the detailed designing of an embedded system.

22.Give some examples for medium scale embedded systems

23.Give some examples for small scale embedded systems.

24.Give some examples for sophisticated embedded systems

25.What are the requirements of embedded system?

26.What are the various models used in the design of an embedded system?

27.Give the characteristics of embedded system?

28.What are the design metrics?

29.What are the challenges of embedded systems?

30.Give the steps in embedded system design?

31.What are the requirements?

32.Give the types of requirements?

33. Define functional requirements?

34.Give some examples of functional requirements?

35.What is the use of requirements form?

36. What are the entries of a requirement form?

37. What is architecture design?

38. Define system integration?

39. What are the functions of memory?

40. Define RAM?

UNIT-II COMPUTING PLATFORM AND DESIGN ANALYSIS

1. Differentiate synchronous communication and iso-synchronous communication.

2.What are the two characteristics of synchronous communication?

3.What are the three ways of communication for a device?

4.Expand a) SPI b) SCI

5. Define software timer.

6.What is USB? Where is it used?

7.What are the features of the USB protocol?

8. Explain briefly about PCI and PCI/X buses.

9.Why are SPCI parallel buses important?

10.What is meant by UART?

11.What does UART contain?

12.What is meant by HDLC?

13. Name the HDLC's frame structure?

14.List out the states of timer?

15. Name some control bit of timer?

16. What is meant by status flag?

17.List out some applications of timer devices?

18.State the special features on I^2C?

19.What are disadvantages of I^2C?

20.What are the two standards of USB?

21. Why do we need at least one timer in an ES?

22. What is the need of Advanced Serial High Speed Buses?

23.What is meant by ISA?

24.What is meant by PCI-X?

25.Define CPCI?

26.Define half-duplex communication.

27. Define full duplex communication.

28. Define Real Time Clock RTC?

29. Define Time-out or Time Overflow?

30.What is I2C?

31.What are the bits in I2C corresponding to?

UNIT-III

PROCESS AND OPERATING SYSTEMS

1.What are the states of a process?
2.What is the function in steady state?

3.Define scheduling.

4.What is scheduling policy?

5.Define hyper period?

6.What is schedulability?

7.What are the types of scheduling?

8.What is cyclostatic scheduling?

9.Define round robin scheduling?

10.What is scheduling overhead?

11.What is meant by context switching?

12.Define priority scheduling?

13. What is rate monotonic scheduling?

14.What is critical instant?

15.What is critical instant analysis?

16. Define earliest deadline first scheduling?

17.What is IDC mechanism?

18.What are the two types of communication?

19.Give the different styles of inter process communication?

UNIT 1V

HARDWARE ACCELARATES AND NETWORKS

1.Name the important terms of RTOS?

2.Define process.

3.Define task and Task state.

4.What is meant by PCB?

5.What are the semaphores related functions supported by MUCOS?

6. Define Task Control Block TCB)

7.What is a thread?

8.Define Inter process communication.

9.What is shared data problem?

10.Define Semaphore.

11.Define Mutex.

12.Differentiate counting semaphore and binary semaphore.

13.What is Priority inversion?

14.What is Deadlock situation?

15.Define Message Queue.

16. Define Mailbox and Pipe.

17. Define Socket.

18. Define Remote Procedure Call.

19.What are the goals of RTOS?

20.What is RTOS?

21.What are the functions of device manager?

22.What are the two methods by which a running requests resources?

23.List the functions of a kernel.

24.List the set of OS command functions for a device

25.List the set of command functions of POSIX file system

26. What are the three methods by which an RTOS responds to a hardware source call on interrupt?

27. Name any two important RTOS.

28. Write short notes on Vxworks?

29.What is meant by well tested and debugged RTOS?

30. What is sophisticated multitasking embedded system?

31. What are the features of UC/OS II?

32. What are the real time system level functions in UC/OS II? State some?

33. Write the interrupt handling functions?

34. What is MICRO C/OS II?

35. Write down the seven task priorities in embedded 'C++'*?*

UNIT V

CASE STUDY

1. What is a PIC?

2. What are the main elements inside a PIC?

3.What are the types of program memory in a PIC?

4.What is MBasic Compiler Software?

5. Define pseudo-code.

ASSIGNMENT QUESTIONS

1. Write the programming to perform code conversion like HEX to ASCII.

2. What are the factors that control interrupt latency? How to keep interrupt latency low?.

3. Describe about Message Queues, Mailboxes and pipes.

4. Briefly explain about Memory Management in RTOS and explain the process of building software for embedded system with a Tool chain diagram.

5. Explain Embedded hardware and software Co-design.

RF AND MICROWAVE ENGINEERING

UNIT 1

TWO PORT NETWORK THEORY

1) Define two-port network.

2) Which one is called junction?

3) Define scattering matrix.

4) What are scattering coefficients?

5) What is waveguide?

6) Why the S-parameters are used in microwaves?

7) Write the properties of [S] matrix.

8) State the reciprocity theorem.

9) Define lossless network.

10) What is the zero property of S-matrix?

11) Write the unitary property for a lossless junction.

12) Define non-reciprocal devices.

13) What is wire?

14) Mention the many forms of wire.

15) Write about the skin effect in a wire.

16) Give a short note on straight-wire Inductance in wire.

17) Define a resistor.

18) Mention the purpose of resistors.

19) Name the types of resistors.

20) What do you meant by capacitors?

21) Define Quality-factor (Q) of Capacitor.

22) Write the applications of inductors.

16 mark Questions:

1. Explain in detail about low frequency parameters.

2. Discuss about high frequency parameters.

3. How microwave junction can be described by scattering matrix. Derive the scattering matrix relation between the input and output of an nxn junction?

4. Discuss about various losses available in microwave?

5. Explain the symmetry property in a reciprocal network.

6. Explain the unitary property in a lossless junction.

7. Explain the transmission matrix for 2-port networks.

8. State and explain the properties of S-parameters.

9. Discuss about behavior of wire at RF with neat diagrams.

10. Write in detail about resistors and its types.

11. Give a detailed note on Inductors.

12. Explain in detail about capacitors.

UNIT-2

RF AMPLIFIERS AND MATCHING NETWORKS

1) Write the function of matching networks?

2) What is function of input and output matching networks?

3) What are the parameters used to evaluate the performance of an amplifier?

4) Define transducer power gain.

5) Define unilateral power gain.

6) What is available Power Gain (GA)at Load?

7) Define Operating Power Gain.

8) Write a short note on feedback of RF circuit.

9) Define unconditional stability.

10) Define noise figure.

16 mark Questions:

1. Discuss various aspects of amplifier-power relations for RF transistor amplifier design.

2. Explain stability considerations for RF transistor amplifier design.

3. Explain various stabilization methods.

4. Discuss gain considerations for RF amplifier.

5. Explain in detail about unconditional stability.

UNIT-3

PASSIVE AND ACTIVE MICROWAVE DEVICES

1) Define microwave.

2) What are the major bands available in microwave frequencies?

3) Enumerate the basic advantage of microwaves.

4) Write the applications of microwaves.

6) Define a microwave junction.

7) Why is magic tee referred to as E-H tee?

8) Define scattering matrix.

9) What are scattering coefficients?

10) What is waveguide?

11) Why, the S- parameters are used in microwaves?

12) Write the properties of [S] matrix.

13) Write the unitary property for a lossless junction.

14) What is H-plane Tee?

15) What is E-plane Tee?

16) Define tee junction.

17) Name some uses of waveguide tees.

18) What are the types of waveguide tees?

19) Define difference arm.

20) What is sum arm?

21) Write the applications of magic tee.

22) What is hybrid ring?

23) What do you meant by hybrid junction?

24) Why bends are used?

25) Name some uses of waveguide twists.

26) Define gradual twists.

27) Give a note on directional couplers.

28) Define coupling factor(C).

24) Define directivity of directional coupler.

25) What do you meant by isolation? i b

26) Define Isolator.

27) What is circulator?

28) Write the characteristics of a three port tee junction.

29) Mention the different types of directional couplers.

30) Define non-reciprocal devices?

31) Define Isolator.

32) What is circulator?

33) Write the properties of ferrites.

34) Write the types of ferrite device.

35) What is gyrator?

36) What do you meant by Faraday rotation?

37) Define 4-port circulator.

38) Write the applications of circulator.

39) Name some uses of isolators.

40) Define Faraday rotation isolator.

16 mark Questions:

1. Discuss about microwave frequency bands.

2. Write the advantage and applications of microwave.

3. Explain a basic microwave system with neat diagram.

4. How microwave junction can be described by scattering matrix. Derive the scattering matrix relation between the input and output of a n x n junction?

5. What are waveguide tees? What are its applications? State different types.

6. Explain the operation of H-plane tee and derive the scattering matrix for it.

7. Explain the operation of E-plane tee and derive the scattering matrix for it.

8. Explain the operation of magic tee and derive the scattering matrix for it.

9. Write about the relation between [S] [Z] and [Y] matrix.

10. Describe in detail the operation of a 2-hole directional coupler.

11. With a neat sketch explain the following:

i. Corners ii. Bends iii. Twists

12. Explain about hybrid circuit. State its applications.

13. Explain directional coupler construction, principle of working and applications.

14. Drive the [S] matrix for directional coupler.

15. With neat diagrams explain different types of directional coupler.

16. What are performance parameters of directional coupler?

17. Explain S-matrix for 2-port networks.

18. State and explain the properties of S-parameters.

19. What are ferrite devices? What are its compositions and application?

20. Explain the construction and working of four port circulator with reference to Faraday rotation principle.

21. Explain the construction working and application of isolator based on Faraday rotation.

22. Explain the operation of gyrator with neat diagram.

UNIT-4

MICROWAVE GENERATION

1) What are the advantages of microwave transistors?

2) What is bipolar transistor?

3) Name the advantages Si bipolar over GaAs.

4) Name the surface geometries available in microwave power transistors.

5) Write the applications of bipolar transistors.

6) What are the configurations available in bipolar transistors?

7) What are the different modes of bipolar transistor?

8) Define saturated drift velocity.

9) What is referred as unipolar transistor?

10) Write the advantages of unipolar transistor?

11) Define homo junction transistor.

12) What do you meant by hetero junction transistor?

13) What are MESFET?

14) Define n-channel JFET.

15) What is called as p-channel JFET?

16) What is called as pinch off?

17) Write the expression for pinch off voltage in JFET.

18) Define ON JFET.

19) Which one is called depletion mode JFET?

20) What is the amplification factor for JFET?

21) What is break down voltage in JFET?

22) Write the applications of GaAs MESFET.

23) Write the applications of GaAs MESFET.

24) Which one is called semi-insulator GaAs structure?

25) Define pinch off voltage.

26) What is called high electron mobility transistor?

27) Define threshold voltage Vth.

28) Name the modes of operation for n-channel and p-channel.

29) Write the advantages of MOSFETs over MESFETs, and JFETs.

30) Describe tunneling phenomenon.

31) What are the key characteristics of a tunnel diode?

32) What are the applications of tunnel diode?

33) Draw the symbol of tunnel diode.

34) What are the advantages and disadvantages of tunnel diode?

35) Explain how a reverse biased pn junction exhibits a capacitor?

16 mark Questions:

1. Explain the constructional details and principle of operation of GaAs MESFET with neat diagrams and characteristic curves.

2. Give the physical structure and equivalent diagram of microwave field effect transistors.

3. Explain the operation of microwave bipolar transistor with neat diagrams.

4. Explain the operation of HEMT with neat diagrams and characteristic curves.

5. Explain the operation of MOSFET with neat diagrams and characteristic curves.

6. Explain the construction and working of tunnel diode.

7. Write advantages and applications of tunnel diode.

8. Explain the construction and working of varactor diode with neat diagram.

9. What are the applications of varactor diode?

10. Explain the field equations of circular waveguide resonator.

11. Explain in detail about Gunn diode with neat diagram?

12. Explain Ridley Watkins Hilsun (RHW) theory with the help of two valley modal.

13. Explain in detail about high field domain.

14. Describe the operating principles of LSA diode?

15. Describe the modes of operation for Gunn diode?

16. Explain the construction and operation of Read diode.

17. What are avalanche transit time device? Explain the operation, construction and applications of the following devices.

(1) IMPATT

(2) TRAPATT

18. Explain the theory of a resistance amplifier?

19. What are parametric devices? Explain the working of a parametric up converter and a down converter?

20. Derive the Manley Rowe power relations. What are the conditions for parametric up converter and down converter?

21. Describe the applications of the parametric amplifiers

22. Explain (1) Degenerate paramp (2) Non degenerate paramp.

23. Explain the fabrication techniques of a monolithic microwave integrated circuit.

24. List out the basic materials required for the manufactured of MMIC.

25. Discuss the discrete, integrated and monolithic microwave integrated circuits?

26. List the basic characteristics required for an ideal substrate material.

27. List the basic properties provided by ideal conductor, dielectric and resistive materials used in MMICs.

28. Describe the MMIC techniques.

UNIT-5

MICROWAVE MEASUREMENTS

1) What is transit time?

2) Write the classification of microwave tubes.

3) Name the two configuration of klystron

4) What is drift space?

5) Define velocity modulation

6) Define bunching.

7) State the power gain, power output and efficiency of two cavity klystron amplifier.

8) Why the output cavity is called as catcher cavity?

9) Mention the application of two cavities.

10) Define electronic efficiency.

11) Define reflex klystron.

12) What do you meant by applegate diagram?

13) Mention the same characteristics of reflex klystrons.

14) State the applications of reflex klystrons.

15) Write a short note on

16) Define electronic efficiency.

17) What is meant by microwave resonators?

18) Define resonant frequency.

19) What are drawbacks available in klystrons?

20) What is TWTA?

16 Mark questions:

1. What is velocity modulation? Explain how velocity modulation is utilized in klystron.

2. Derive an expression for the efficiency of a two cavity klystron amplifier.

3. What are the characteristics and applications of klystron amplifier?

4. What is klystron? Describe its operation and obtain an expression for its power output.

5. Derive the power output for two cavity klystron amplifier.

6. Derive the expression for optimum distance of klystron in bunching process.

7. Draw and explain the operation of klystron oscillator.

8. Derive the expression for velocity modulation in klystron oscillator.

9. What are the assumptions made when analysis a two-cavity klystron.

10. Explain the working of a TWT amplifier with neat sketch.

11. Write the advantages and applications of TWT.

12. Derive Hull cutoff condition with respect to magnetron.

13. Explain the working of a magnetron with p - mode oscillation.

14. Explain the construction and working of cylindrical magnetron.

15. Derive the expression for cyclotron angular frequency of cylindrical magnetron.

16. Derive the expression for power output and efficiency of cylindrical magnetron.

17. Write short notes on

a. Low VSWR b. High VSWR

18. Explain the attenuation loss measurement with neat diagram?

19. Explain about power meter using double bridge?

20. Explain high power measurements by calorimetric method?

21. Explain the method of measuring impedance of a given load, with suitable diagram?

22. Explain frequency and wavelength measurements with neat diagrams?

23. Write short notes on

a. Average power

b. Bolometer sensor

c. Schottky Barrier Diode sensor

d. Thermocouple sensor

Assignment Questions

1. The S-parameters of a two port network are given by

   $S_{11} = 0.2\angle 90°$, $S_{22} = 0.2\angle 90°$, $S_{12} = 0.5\angle 90°$, S_{21}

   Determine whether the network is lossy or not.

(i) Is the network symmetrical and reciprocal? Find the insertion loss of network.

2. State and prove the unitary property of scattering matrix of N- port junction.

3. Explain about the Ridley-Watkins-Hilsum (RWH} theory.

4. Discuss about the Stability consideration and gain consideration for the amplifier.

5. Elaborate the process associated with the Multi cavity klystron.